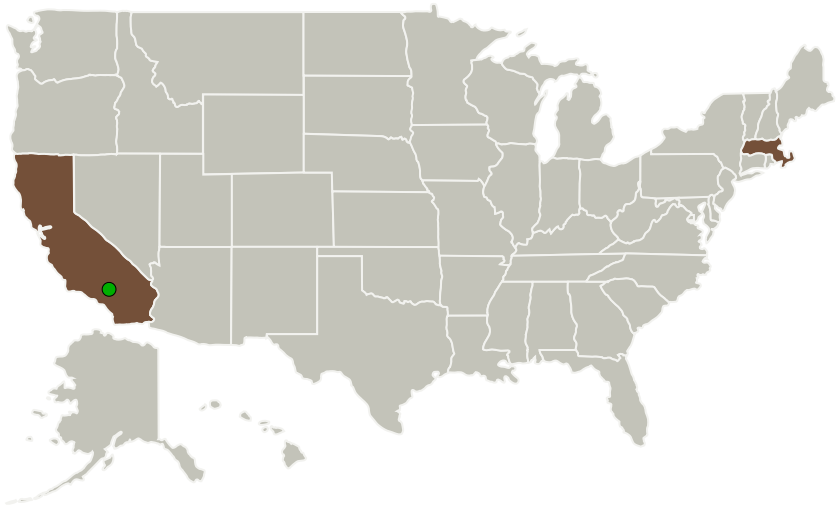
Magnesium Based Rockets for Martian Exploration, Phase I

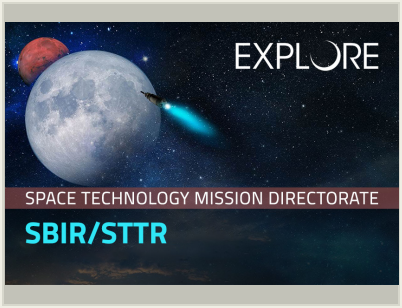
Completed Technology Project (2010 - 2010)

Project Introduction

We propose to develop Mg rockets for Martian ascent vehicle applications. The propellant can be acquired in-situ from MgO in the Martian regolith (5.1% Mg by mass) and combusted with H20 that exists at the poles and below the surface. The vacuum Isp of a Mg-H20 rocket would be ~300 s. Mg can also be combusted with CO2 condensed from the Martian atmosphere to yield Isp ~215 s. The technology can also be used on the Moon, where regolith is 5.5% Mg. Al-H20 rockets would also be enabled; like Mg, Al is present in Martian and Lunar regolith. In Phase I, we will prove the feasibility of Mg rockets. Chemical Equilibrium Analysis codes will be used to predict rocket performance at various operating conditions and O/F ratios. Combustion with CO2, H20, and pure O2 will be considered. Experiments will focus on developing and characterizing delivery, ignition and combustion systems, starting with ARL's existing Mg combustion system. Ways to achieve low temperature, electrolytic ignition and stable combustion will be studied. Drawing upon both experimental and theoretical results, we will then design a 5-10 N metal-water rocket system to be built and tested in Phase II.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Busek Company, Inc.	Lead Organization	Industry Women-Owned Small Business (WOSB)	Natick, Massachusetts
Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140038)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Busek Company, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

James Szabo

Co-Investigator:

James Szabo

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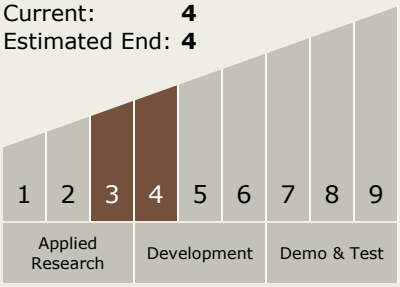
Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.5 Hybrids

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System